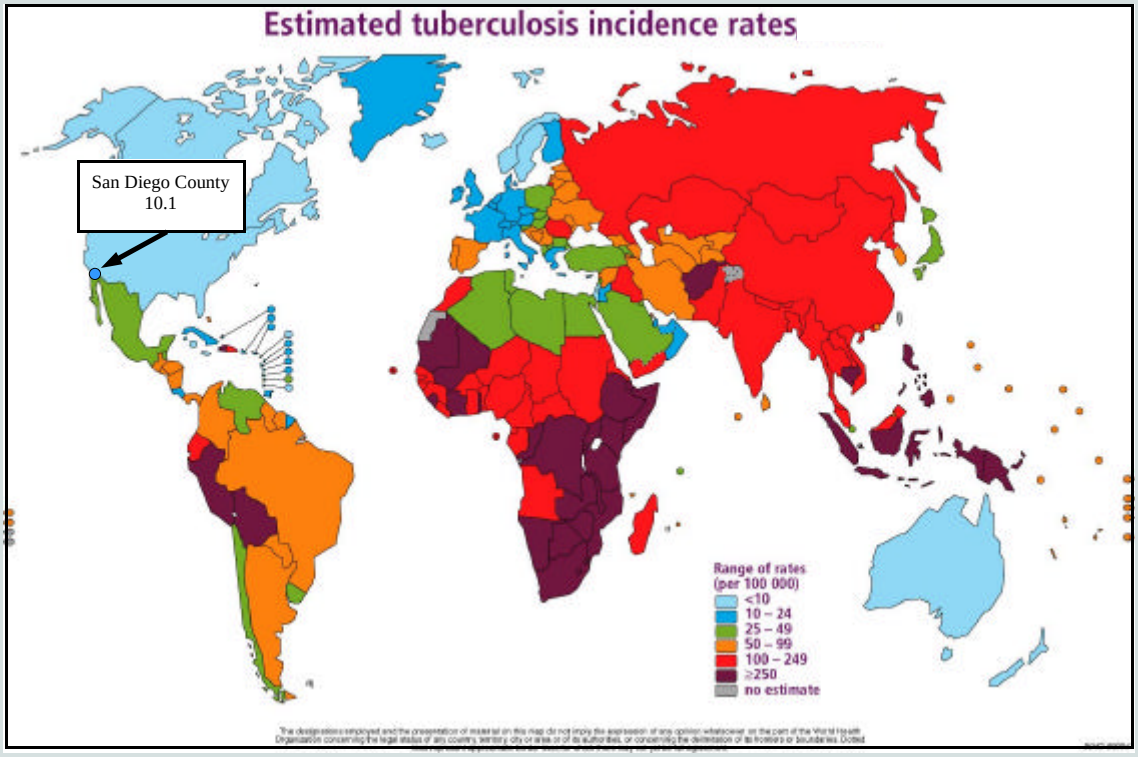
County of San Diego
Health and Human Services Agency
Office of Public Health

Tuberculosis Control Program
2000 Annual Report



Tuberculosis Control Program

Kathleen S. Moser, MD, MPH
Chief

Anne Hassidim, RN, MSN
Program Manager

Philip A. LoBue, MD
Medical Epidemiologist
Centers for Disease Control and Prevention

Wendy Betancourt, MPH
Epidemiologist

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Introduction

Tuberculosis (TB), an infectious disease caused by the bacterium *Mycobacterium tuberculosis,* is one of the leading infectious causes of death in the world today (see cover for estimated case rates by country). It is estimated that one third of the world's population is infected with TB .

In the United States (US), TB was the leading cause of death in 1900. With the advent of effective treatment, the US experienced a steady decline in cases until the mid-1980s. A resurgence of TB occurred at that time, with national case rates peaking in the early 1990s. Through extensive public health interventions at the national, state, and local levels, TB is once again on the decline. Nationally, this trend continues with the year 2000 seeing the fewest reported cases in the US since 1953, the first year in which TB statistics were systematically recorded.

Case Counts and Rates

Trends in TB case rates in San Diego County have generally paralleled those of the US, although the absolute rates have been greater. In 2000, San Diego County reported 295 TB cases with a case rate* of 10.1 per 100, 000 (Figures 1 and 2). This represents a 1% decrease in cases from 1999 and a 37% decrease from 1993, the peak year of TB resurgence in San Diego County. In 2000, 16, 372 TB cases (case rate of 5.8) were reported in the US and 3, 295 cases (case rate of 9.7) were reported in California.

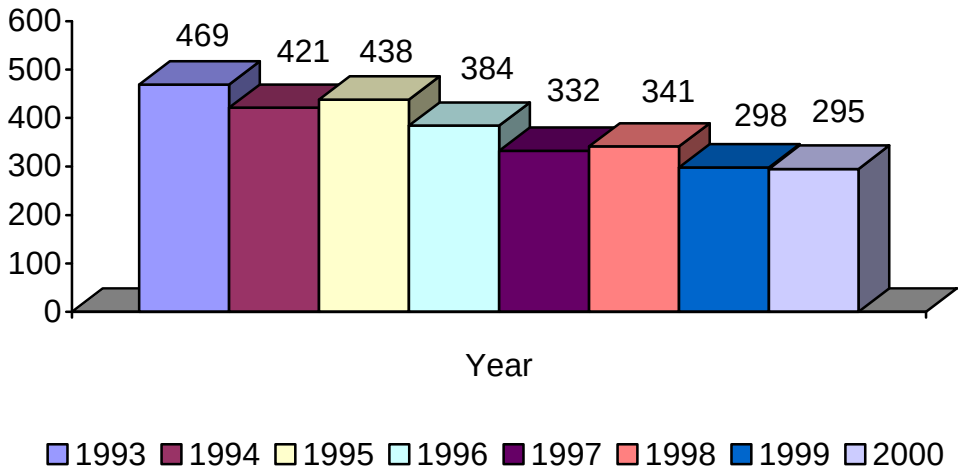

Figure 1: TB Cases in San Diego County, 1993-2000

* Unless otherwise specified, case rates are per 100, 000.

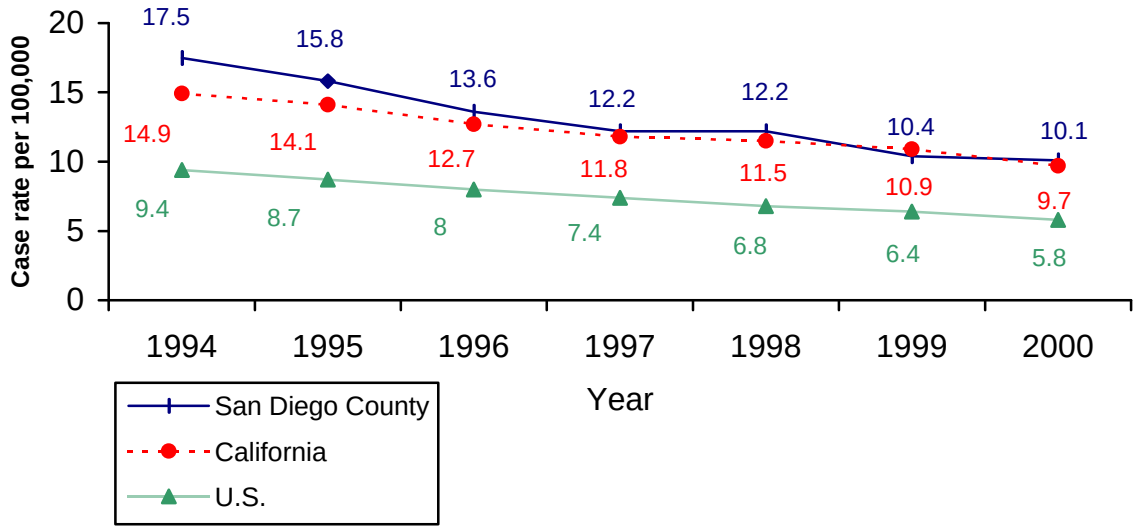

Figure 2: TB Case Rates in San Diego County, California, and the US, 1994-2000

Age

Children ages 0 to 4 accounted for 5% of cases in 2000 (Figure 3). There were 14 cases in this age group, a 64% decrease from 1993 (39 cases). TB cases in young children are particularly important because they indicate recent transmission of disease. The median age of TB cases was 43, and ranged from 0 to 93 years of age. Persons aged 25 to 44 made up the largest group of TB cases, with 106 (36%). However, as a proportion of the population at risk, the 65 and older age group (56 cases) had the highest case rate (16.7).

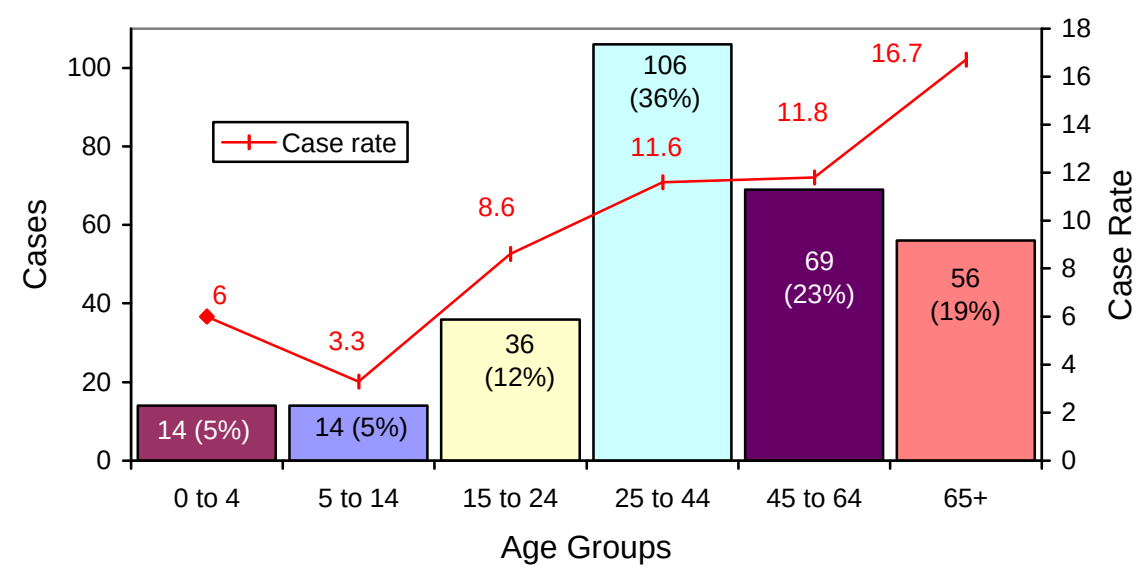

Figure 3: Case Distribution and Rates by Age in San Diego County, 2000

Race and Ethnicity

The distribution of TB cases in San Diego County by race/ethnicity in 2000 was 48% Hispanic, 35% Asian, 9% White, and 8% Black (Figure 4). The highest case rate (37.2) was found among Asians, followed by Hispanics (19.5), Blacks (13.3), and Whites (1.6).

For California (1999 data), the largest percentage of TB cases was found among Asians (39%), followed by Hispanics (37%), Whites (12%), Blacks (10%), and Native Americans (<1%). For the US (1999 data), the distribution of TB by race/ethnicity was 32% Black, 24% White, 22% Hispanic, 20% Asian, and 1% native American. (Complete demographic data for 2000 TB cases for California and the US are not yet available.)

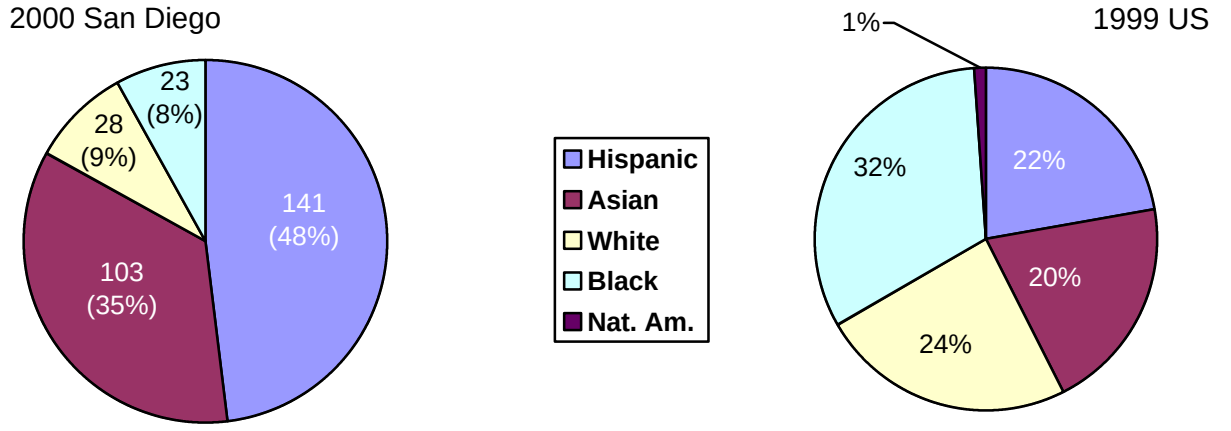

Figure 4: TB Cases by Race/Ethnicity in San Diego County (2000) and the US (1999)

Case rates by race/ethnicity are shown in Figure 5. For San Diego County (37.0), California (36.7), and the US (35.3), Asians had the highest case rate. Whites had the lowest case rate for California (2.6) and the US (2.2) and the second lowest case rate for San Diego County (1.6). For San Diego County, the lowest case rate occurred in Native Americans (no TB cases in 2000). The Healthy People 2010 goal for the overall US case rate is 1.0 (red line in Figure 5). As can be seen from the graph, only Whites are currently approaching this target.

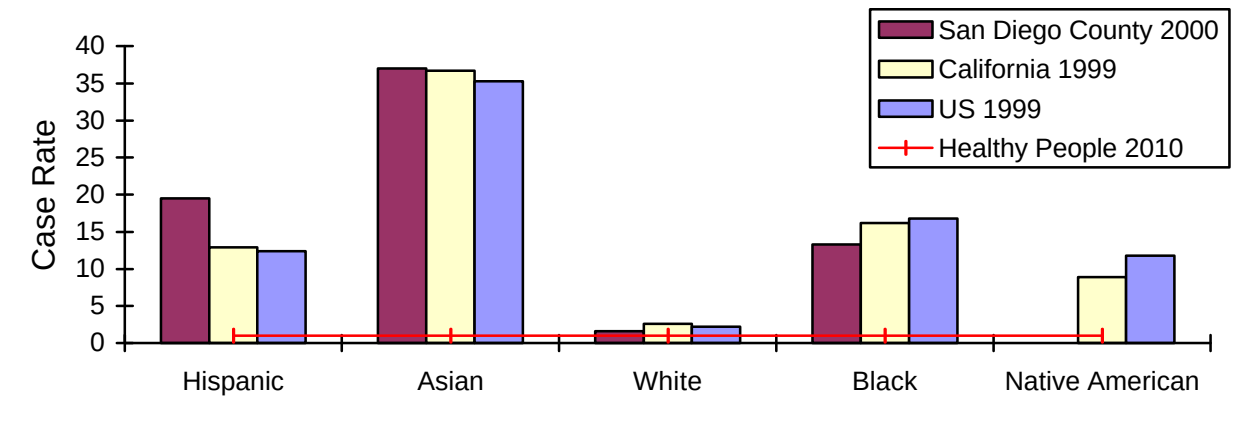

Figure 5: TB Case Rates by Ethnicity in San Diego County (2000), California (1999), and the US (1999) Compared to Healthy People 2010 Goal

Foreign Birth

A notable trend in TB epidemiology in the US has been the increase in the proportion of cases occurring in persons of foreign birth. Between 1992 and 1999, the percentage of TB cases in the foreign born increased from 27% to 44% (Figure 6). The number of cases in foreign-born persons remained at approximately 7, 500 per year. During the same time period, cases among US-born individuals decreased from more than 19,000 in 1992 to fewer than 10, 000 in 1999. The most common countries of origin for persons of foreign birth with TB in the US in 1999 were Mexico (23%), the Philippines (12%), and Vietnam (10%) (Figure 7).

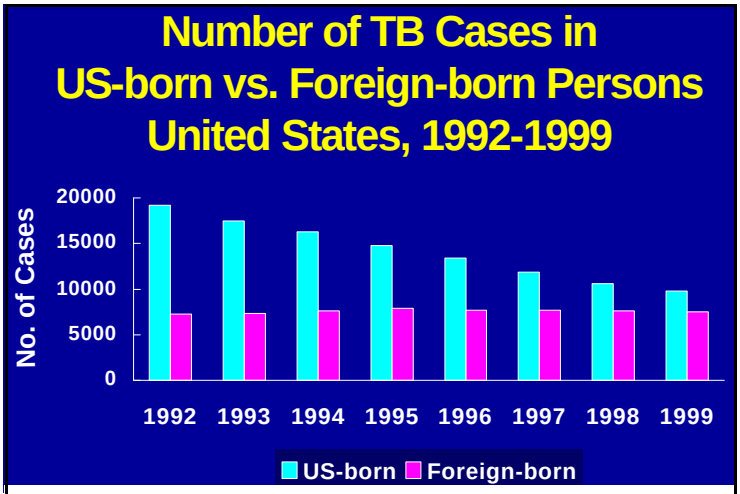

Figure 6

In San Diego County, foreign-born persons have consistently accounted for greater than 65% of TB cases (Table 1). In 2000, foreign-born persons comprised 76% of cases in San Diego County. The most common countries of origin for foreign-born TB cases in San Diego County in 2000 were Mexico (46%), the Philippines (28%), and Vietnam (9%) (Figure 8).

Recent studies of TB epidemiology in the foreign-born have shown that the majority of cases occur in immigrants who have been in the US for more than five years. The median time between arrival in the US and diagnosis of TB was 8.9 years for year 2000 foreign-born TB cases in San Diego County.

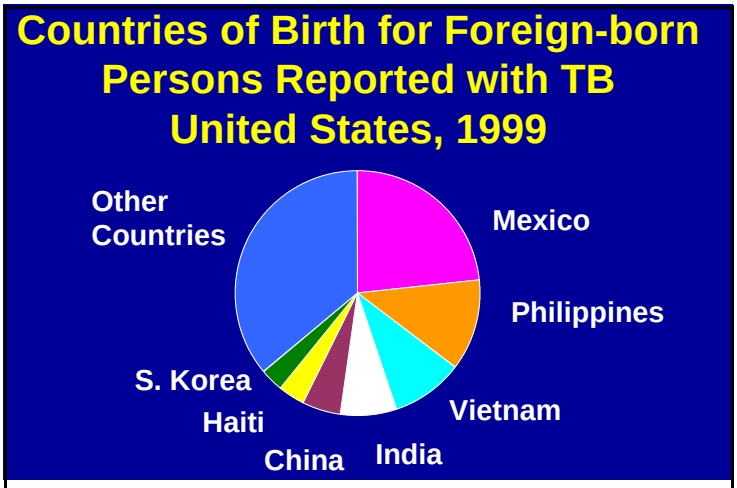

Figure 7

Case rates, however, are higher in recent immigrants (in the US less than five years). This pattern is also seen in San Diego County. The overall case rate for San Diego County 2000 foreign-born TB cases was 38.2, compared with 3.1 for US-born cases.

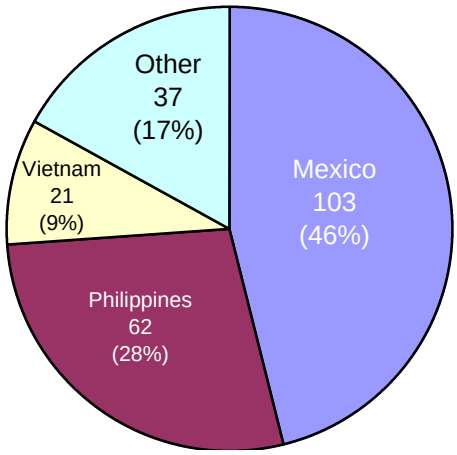

Figure 8: Countries of Birth for Foreign-born Persons with TB in San Diego County, 2000

Country of Origin	1995	1996	1997	1998	1999	2000
THE AMERICAS	**272**	**235**	**192**	**224**	**190**	**179**
United States	132	123	112	113	97	72
Mexico	125	105	76	106	87	103
Other	15	7	4	5	7	4
ASIA	**151**	**127**	**126**	**105**	**94**	**96**
Vietnam	33	26	17	14	18	21
Philippines	81	80	78	67	62	62
Other	37	21	31	24	14	13
EUROPE	**5**	**4**	**3**	**4**	**4**	**2**
AFRICA	**10**	**16**	**7**	**6**	**8**	**14**
OTHER/UNKNOWN	**0**	**2**	**4**	**2**	**1**	**4**
TOTAL	**438**	**384**	**332**	**341**	**298**	**295**
% Foreign-born	**70**	**67**	**66**	**67**	**67**	**76**

Table 1: TB Cases in San Diego County by Country of Origin, 1995-2000

Geographic Distribution

San Diego County encompasses approximately 4, 000 square miles. The distribution of 2000 TB cases in San Diego County by health region is shown in Figure 9. The largest number of cases occurred in the South Region (86) which also had the highest case rate (21.6) Figure 10 shows a spot map of the distribution of TB cases in San Diego County. Case rates by zip code are demonstrated in Figures 11 and 12. Zip codes with case rates above that of San Diego County as a whole, and especially zip codes with case rates above 15, were concentrated in the Central and South Regions.

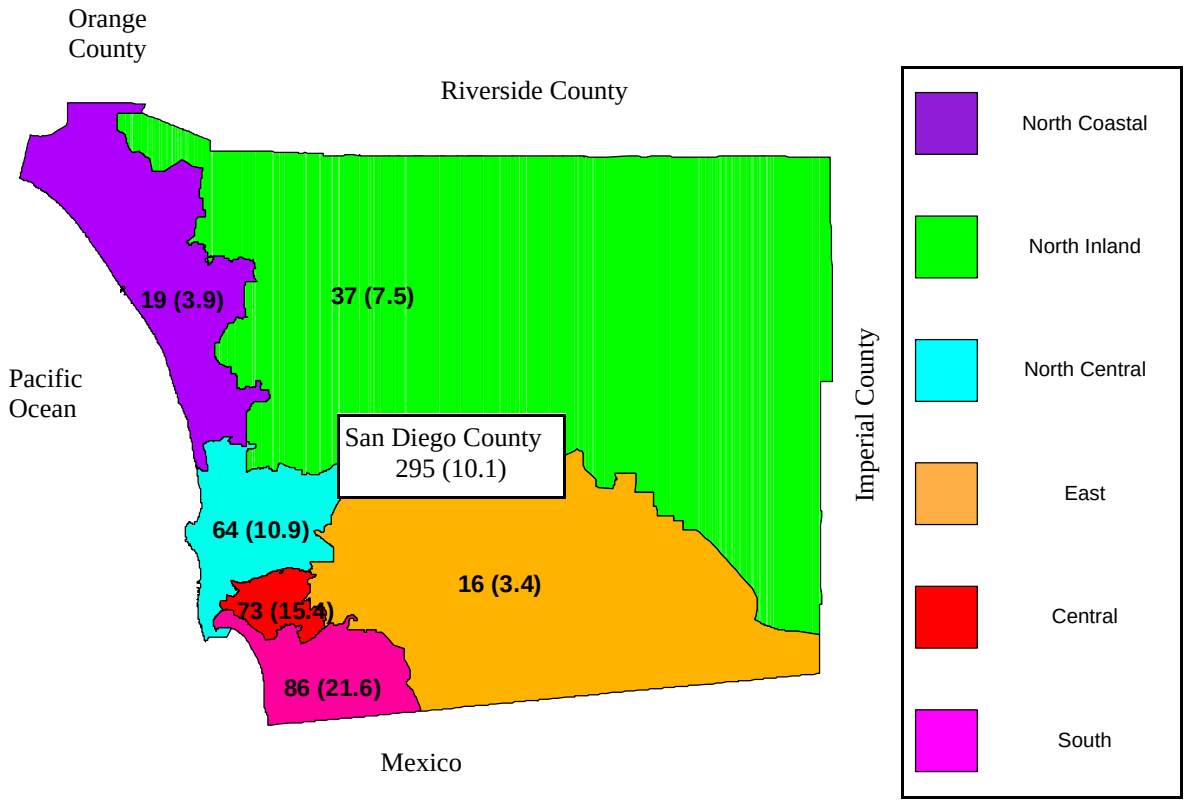

Figure 9: San Diego County TB Cases by Region, 2000
(case rates per 100,000 are shown in parentheses)

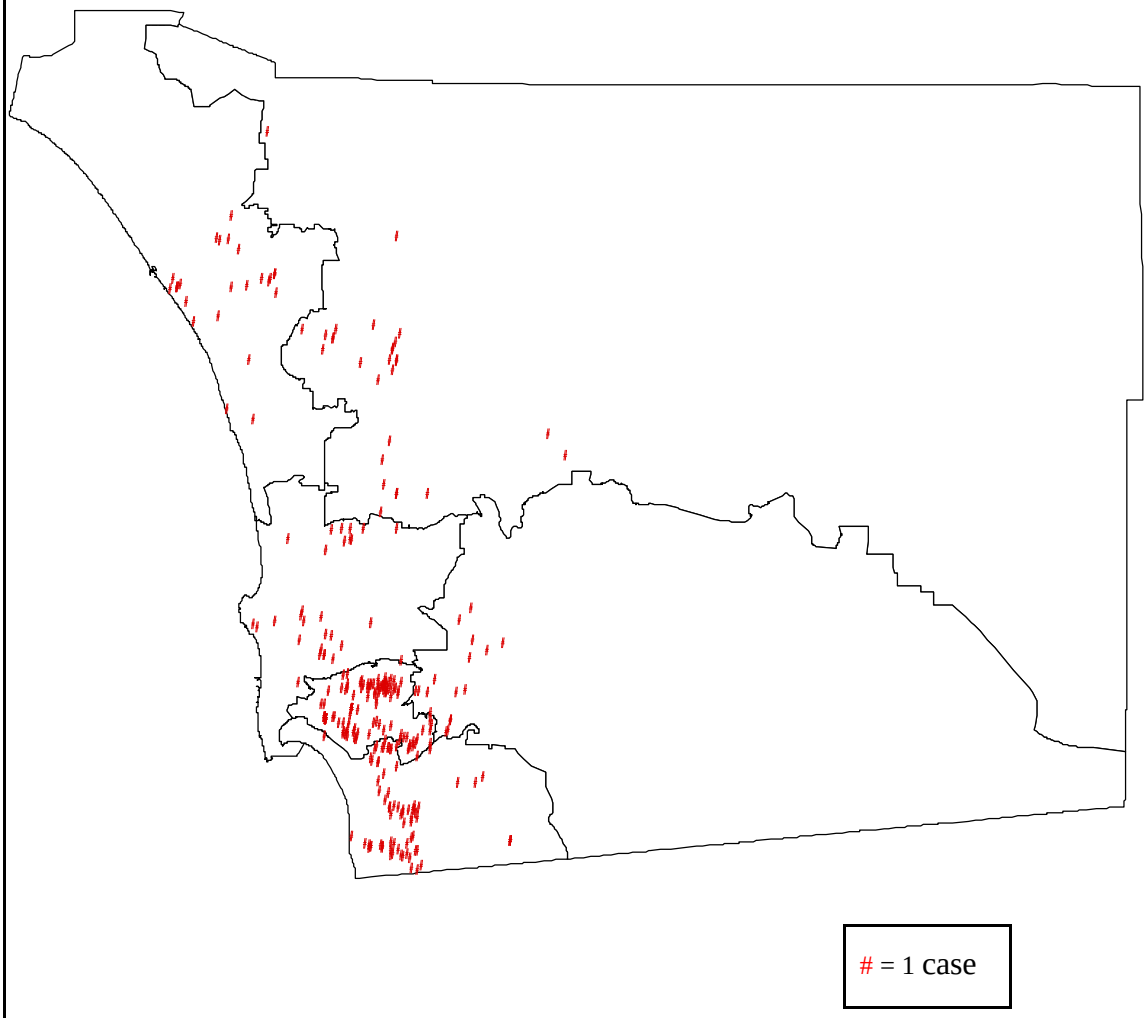

Figure 9: Spot Map Show Distribution of TB Cases in San Diego County, 2000

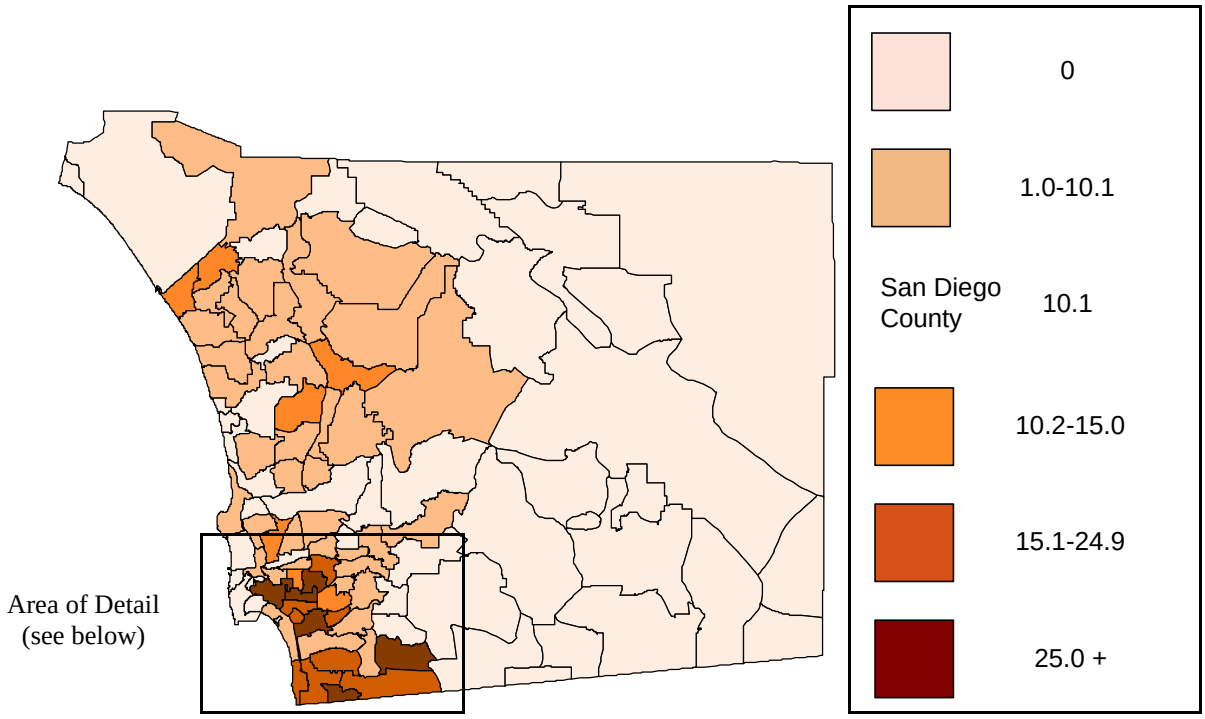

Figure 10: TB Case Rates by Zip Code for San Diego County, 2000

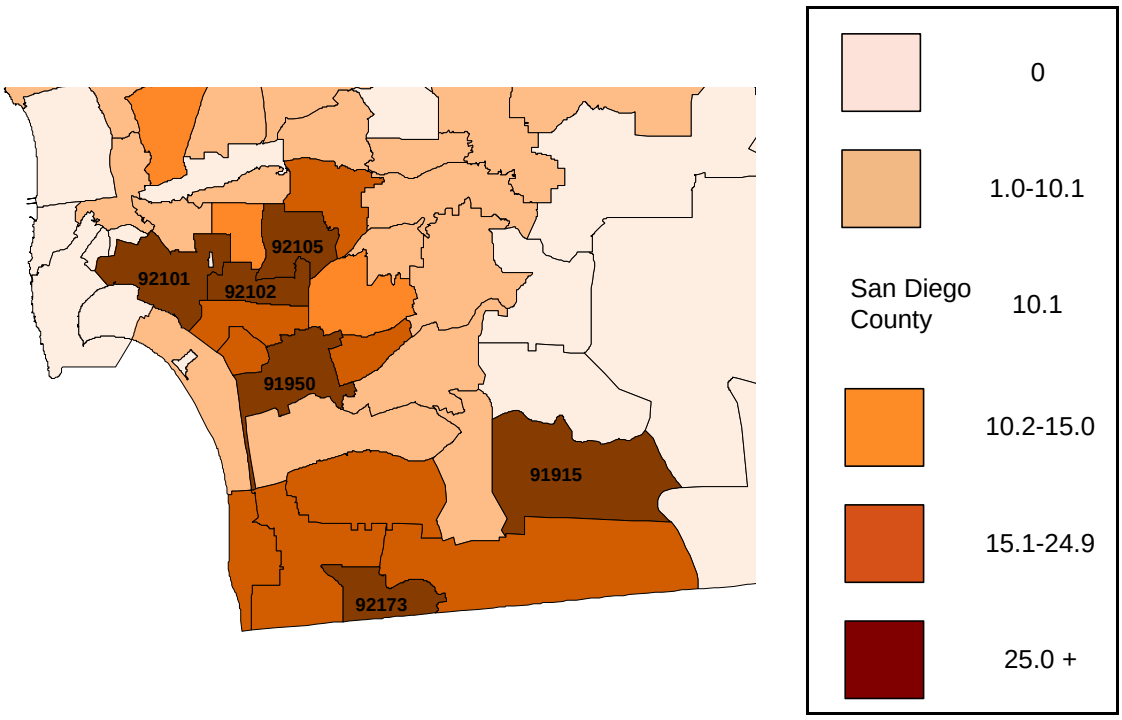

Figure 11: TB Case Rates by Zip Code, Zoom-in of Central and South Regions, 2000

Cases distributed by city are shown in Table 2. The city of San Diego had 168 cases (57% of total) with a case rate of 13.2. The cities with the highest case rates were San Ysidro (35.3), National City (28.9), and Imperial Beach (20.6).

City	Cases	Rate	City	Cases	Rate
Carlsbad	3	3.7	National City	16	28.9
Chula Vista	25	14.3	Oceanside	13	8.1
Coronado	1	4.1	Poway	1	2.0
Del Mar	0	-	San Diego	168	13.2
El Cajon	6	6.2	San Marcos	7	13.0
Encinitas	2	3.2	San Ysidro	10	35.3
Escondido	11	8.6	Santee	0	-
Imperial Beach	6	20.6	Solana Beach	0	-
La Mesa	3	5.1	Vista	7	8.2
Lemon Grove	2	7.7	Other (10 cities)	14	NA*

Table 2: San Diego County TB Cases and Case Rates (per 100,000) by City, 2000

Body Site of Disease

The distribution of TB cases by primary site of disease is shown in Figure 13. The majority of cases were pulmonary (80%). The percentage of cases of pulmonary TB has remained fairly constant (73-80%) since 1994. Of patients with pulmonary disease as the primary site, 9.3% also had disease at an extrapulmonary site. Fifty-nine percent of patients with pulmonary TB had at least one positive acid-fast bacillus (AFB) smear (indicative of a increased probability of infectiousness). TB of the lymph nodes was the second most common site of disease in 2000 (10%), a figure which has also shown little variation (9-11%) since 1995.

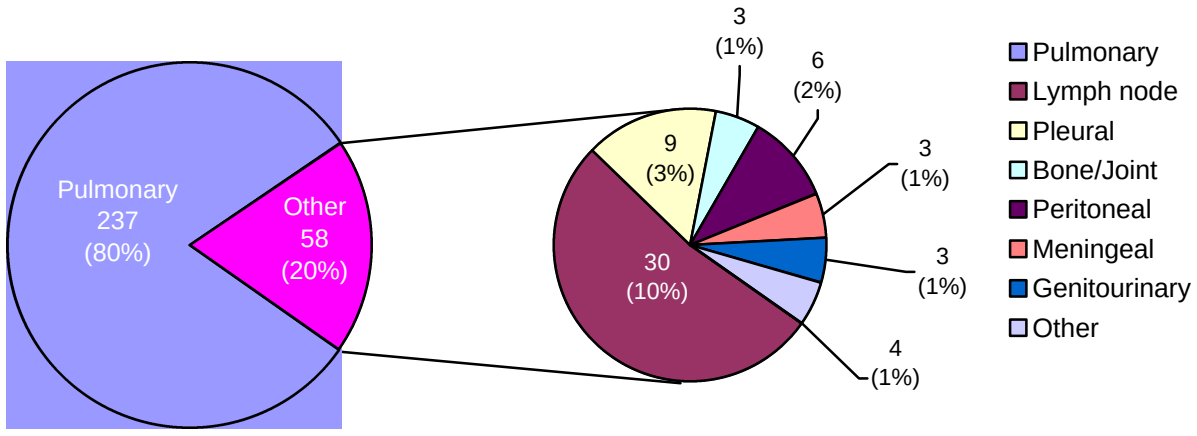

Figure 13: San Diego County TB Cases by Body Site of Disease, 2000

* not available

HIV Co-infection

Individuals co-infected with HIV are more susceptible to acquiring TB infection and progressing to active disease. While the lifetime risk for progression from infection to disease is under 10% for immunocompetent persons, the risk for progression in the HIV infected is approximately 8% per year. Active TB is more likely to disseminate to organs outside the lung in HIV patients and they are at increased risk for significant morbidity and mortality.

In 2000 in San Diego County, 17 patients with TB were co-infected with HIV, about 6% of total TB cases (Figure 14). Fifty-nine percent (compared to 29% of all cases) of TB/HIV cases had disease at an extrapulmonary site with or without pulmonary TB (6% had extrapulmonary disease only). The estimated TB case rate for HIV infected persons was 152.6. This was greater than 15 times the overall case rate in San Diego County.

In 2000, most TB/HIV cases occurred in males (83%). Hispanics (67%) and Blacks (22%) comprised the majority of cases by race/ethnicity. People in the 25-44 age range (78%) were the most likely to have TB and HIV compared with other age groups.

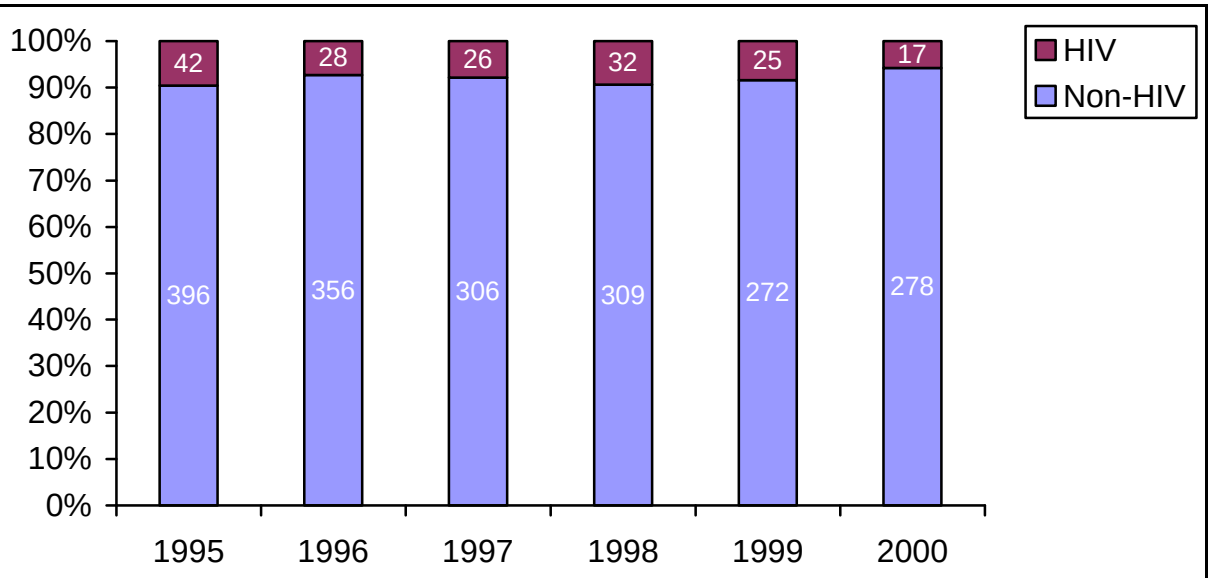

Figure 14: HIV Cases as a Proportion of All TB Cases in San Diego County, 1995-2000.

Other High Risk Groups: Homelessness, Substance Abuse, Incarceration

A number of other conditions are associated with an increased risk for TB infection and disease. Among these are homelessness, substance abuse, and incarceration in jail or prison. Of 295 patients with TB in 2000, 18 (6%) were homeless, 29 (10%) abused alcohol, 7 (2%) injected drugs, 21 (7%) used non-injected drugs, and 15 (5%) were diagnosed while in a correctional facility (county jail: 2, state prison: 2, federal prison: 10, juvenile hall: 1) (Figure 15).

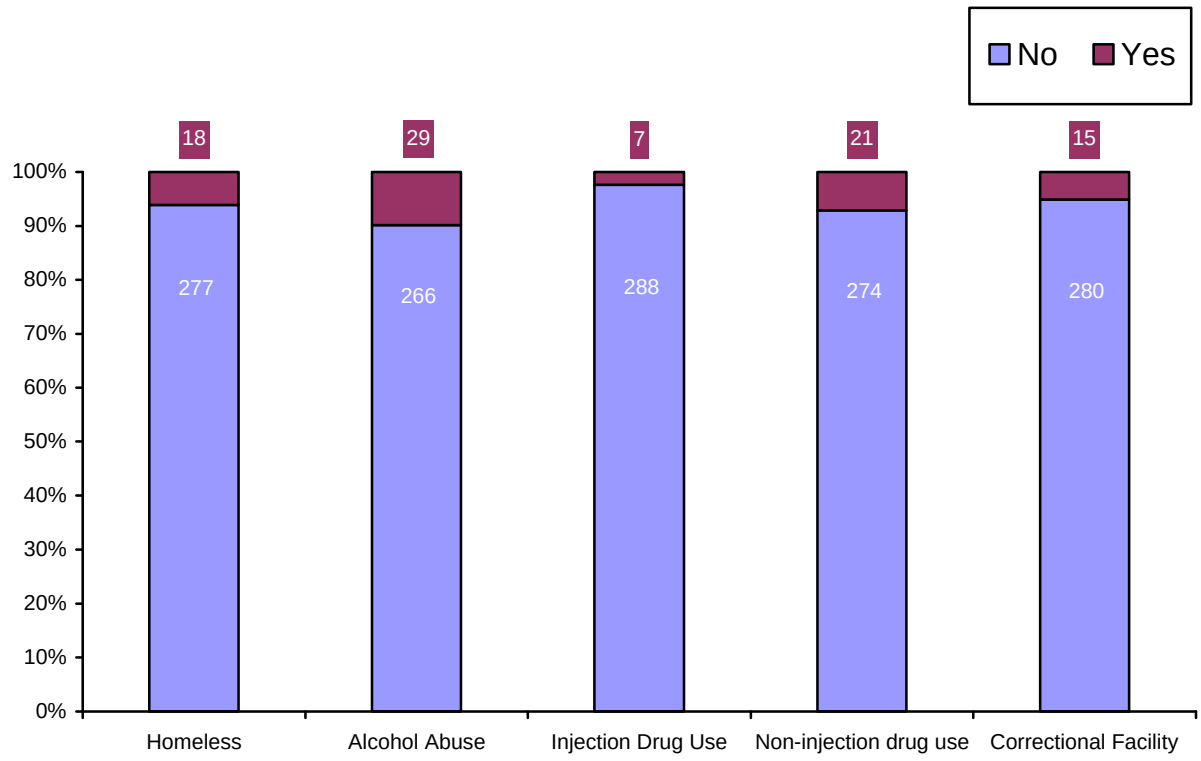

Figure 15: San Diego County TB Cases, 2000
Homelessness, Substance Abuse, Correctional Facilities

Drug Resistant TB

TB may become resistant to medications if treatment is inadequate because of patient non-adherence or medical provider error. Resistant TB is more difficult to treat successfully, especially multi drug-resistant (MDR) TB, defined as TB which is resistant to both isoniazid and rifampin. MDR TB has a lower cure rate and a higher mortality rate.

In 2000, positive cultures for *M. tuberculosis* complex were obtained in 261 (88%) TB cases. The remaining 34 cases did not have cultures obtained or all cultures were negative. Drug resistance patterns for 2000 cases are shown in Figures 16 and 17. Of 261 culture proven TB cases, 63 (25%) were resistant to one drug (not including MDR), 5 (2%) were resistant to two or more drugs (not MDR) and 8 (3%) were MDR. Patients with a prior history of TB treat-

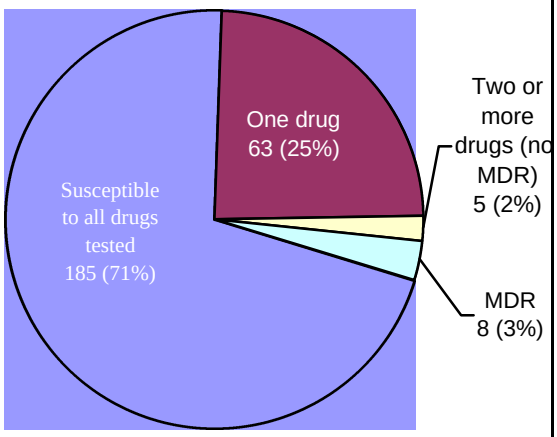

Figure 16: San Diego County TB Cases, 2000
Drug Resistance

ment were more than twice as likely to manifest drug resistance than those without prior therapy (57% vs. 24%). The percentages of drug resistance in US-born (29%) and foreign-born (24%) cases were similar. Four of the 8 MDR cases had a history of prior TB treatment and 7 of the 8 were born outside the US (Mexico: 5, Philippines: 2).

In terms of individual medications, 31 (12%) cases were resistant to isoniazid, 27 (12%) were resistant to pyrazinamide, 0 were resistant to rifampin alone, and 8 (3%) were resistant to isoniazid and rifampin (MDR). Because isoniazid resistance exceeds the recommended threshold of 4%, all TB suspects and cases in San Diego County should be started on four drug chemotherapy (usually isoniazid, rifampin, ethambutol, and pyrazinamide) while susceptibility results are pending. In 2000, isoniazid resistance varied by age group. There were no isoniazid-resistant TB cases in patients under 15 years of age. The highest degree of isoniazid resistance occurred in the 45-64 (18%) and 25-44 (15%) age groups (Figure 18).

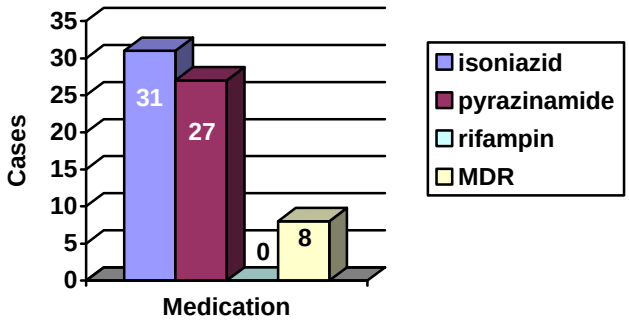

Figure 17: Resistance to Individual Medications in San Diego County TB Cases, 2000

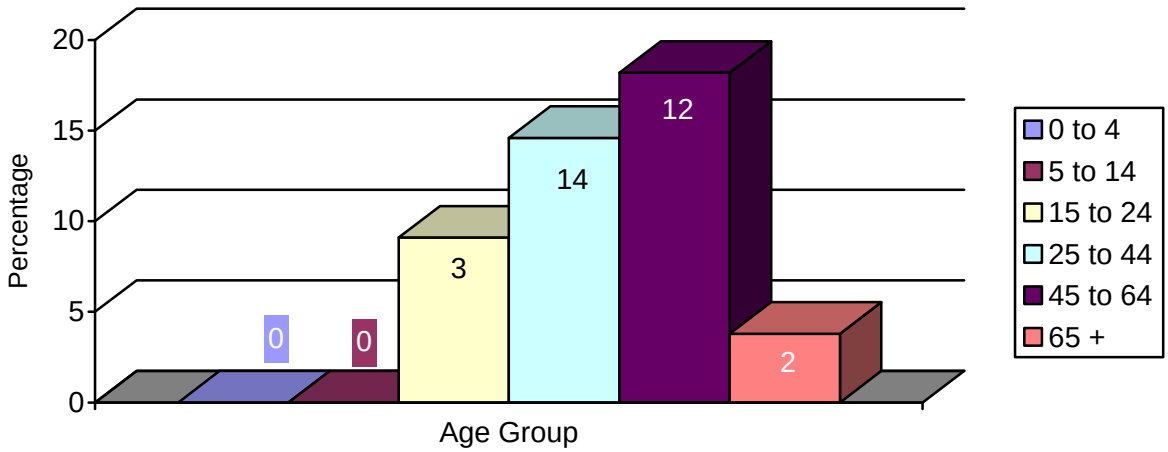

Figure 18: Percentage of Isoniazid Resistance by Age Group in San Diego County TB Cases, 2000 (Numbers in bars represent numbers of cases.)

Disease Due to *Mycobacterium bovis*

Disease due to *Mycobacterium bovis*, also known as bovine tuberculosis, is usually contracted through the consumption of unpasteurized dairy products. Person-to-person transmission via inhalation of aerosolized organisms (the method through which *M. tuberculosis* is spread - see "Evaluation of Close Contacts to TB Cases") is also believed to occur.

In 2000, 20 cases of *M. bovis* disease were reported in San Diego County (Figure 19). Since 1993, there have been 127 reported cases in the county. Except for 1993 (2 cases) and 1998 (26 cases), the number of cases per year has been fairly constant (11-20) over this period. Most cases occurred in Hispanics (116, 91%) who were either born in Mexico (68, 54%) or the US (56, 44%). In 2000, 100% of *M. bovis* cases occurred in Hispanics born in Mexico (45%) or the US (55%). Between 1993 and 2000, 22 patients (17%) with *M. bovis* disease were HIV-infected. Fifty-six (52%) patients had disease at an extrapulmonary site. Because *M. bovis* disease is usually contracted by ingestion of contaminated dairy products, it is not surprising that peritoneal disease (12 cases, 9%) occurred more than 8 times as frequently as with *M. tuberculosis*.

M. bovis is uniformly resistant to pyrazinamide and accounted for 74% of pyrazinamide resistant cases in 2000. Since 1993, about 5% of *M. bovis* isolates have been resistant to isoniazid. Isoniazid resistance occurred more frequently in pulmonary cases (6.5%) than extrapulmonary cases (3.6%) and more frequently in patients 15 years of age and older (5.5%) than patients 0-14 years of age (3.5%). There has been one case of MDR *M. bovis* disease (0.8%) in San Diego County since 1993.

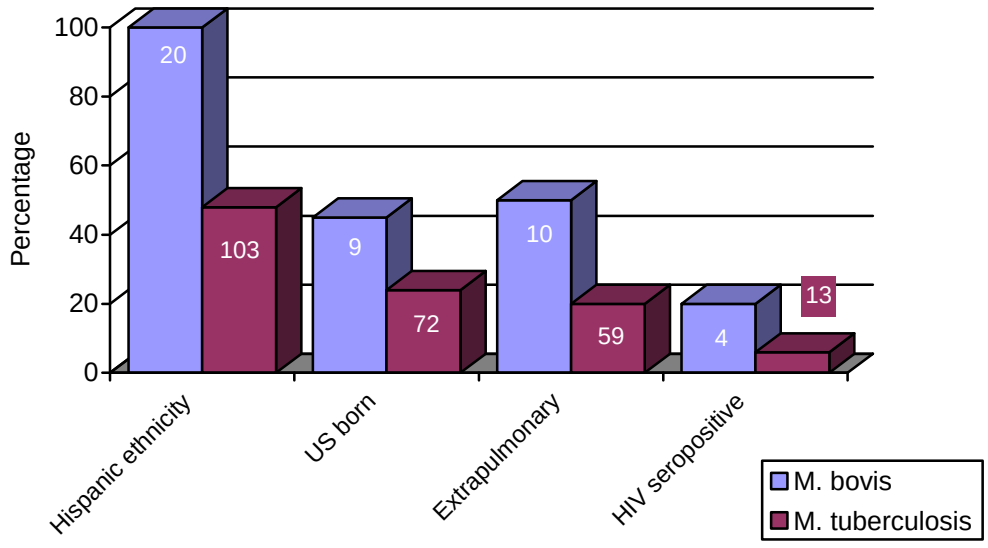

Figure 19: *M. bovis* and *M. tuberculosis*: Comparison of San Diego County Cases, 2000 (Numbers in bars represent numbers of cases.)

Treatment Outcomes (1995-1999† Cohorts)

From 1995 through 1999, 1, 729 patients with TB were started on treatment in San Diego County. Overall 86 percent of these patients completed treatment (Table 3) with 74 percent completing within 12 months. When patients who died or moved were excluded, the overall and 12 month completion rates were 98 and 84 percent, respectively.

	1995	1996	1997	1998	1999	Total
Started Treatment*	425	367	311	334	292†	1,729
Completed (<= 12 mos.)	303	256	225	250	230	1,264
Completed (>12 mos.)	58	60	43	36	19	216
Still on Treatment	0	0	0	0	12	12
Moved	27	22	19	17	13	98
Died	28	24	21	22	15	110
Lost	1	2	0	2	2	7
Refused	1	0	0	0	0	1
Other	7	3	3	7	1	21
Percent Completion	**85%**	**85%**	**87%**	**86%**	**89%**	**86%**
Percent Completion (Excluding Died and Moved)	**98%**	**98%**	**99%**	**97%**	**99%**	**98%**
Percent Completion within 12 Months	**71%**	**70%**	**72%**	**75%**	**82%**	**74%**
Percent Completion within 12 Months (Excluding Died and Moved)	**82%**	**80%**	**83%**	**85%**	**91%**	**84%**

* Excludes patients who died prior to the start of treatment.

†Completion rates exclude patients still on treatment.

Table 3: Treatment Outcomes, 1995-1999

Treatment Outcomes for 1999 Cohort: Medical Provider Type

In San Diego County, most TB patients are treated, at least in part, by community providers. The TB Control Program provides case management and other assistance for all TB cases, regardless of medical provider type. For the 1999 cohort (closed cases), 82 (28%) patients received treatment solely from community providers, 102 (35%) patients were treated at the TB Control Clinic, and 95 (33%) received treatment from a combination of both (Figure 20). Using an intent-to-treat analysis (i.e. including patients who died or moved), treatment outcomes were

† Much of the outcome data for the 2000 cohort is not yet available as many patients remain on treatment.

better for patients treated solely at the TB Control Clinic (94% completion) than for those treated by community providers (79% completion). However, when patients who moved or died were excluded, the completion rates were similar: 98 and 100 percent for TB Control Clinic and community providers, respectively. Of those completing therapy, 96% of cases treated at TB Control Clinic and 98% of cases treated by community providers finished within 12 months.

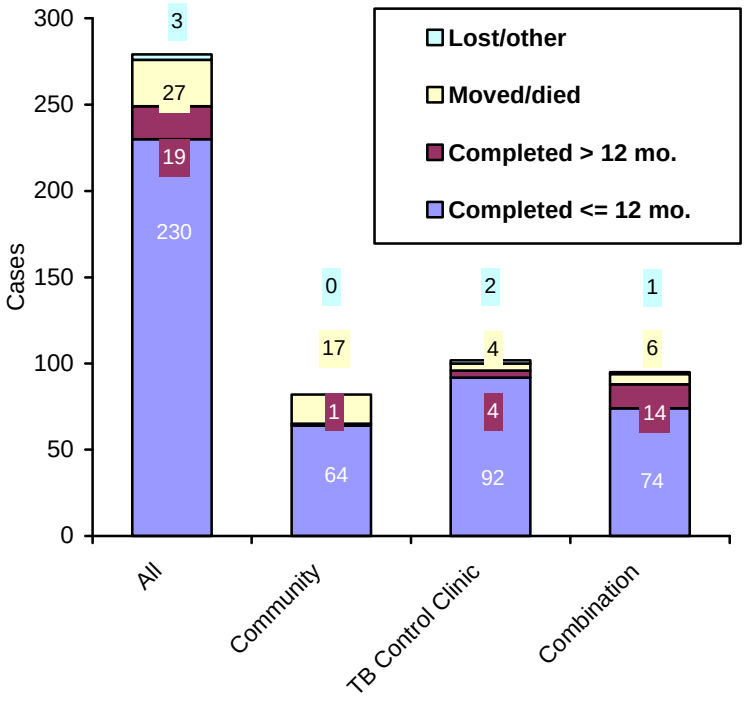

Figure 20: San Diego County TB Cases Outcomes by Medical Provider Type, 1999

Use of Directly Observed Therapy in 1999 TB Cases

To treat active tuberculosis, multiple medications must be given for at least six months. If therapy is interrupted or taken inappropriately, drug resistance may develop. In order to overcome the problem of patient non-adherence to treatment, many health departments offer directly observed therapy (DOT). DOT entails the administration of medication under the direct observation of a nurse or outreach worker. Use of DOT has been demonstrated to increase TB cure rates and decrease acquired and primary drug resistance.

Because DOT is resource intensive, San Diego County TB Control has not instituted a policy of universal DOT. Nevertheless, San Diego County TB Control attempts to honor all physician requests for this service. Priority for DOT is given to patients with drug resistance, suspected or documented non-adherence to treatment,

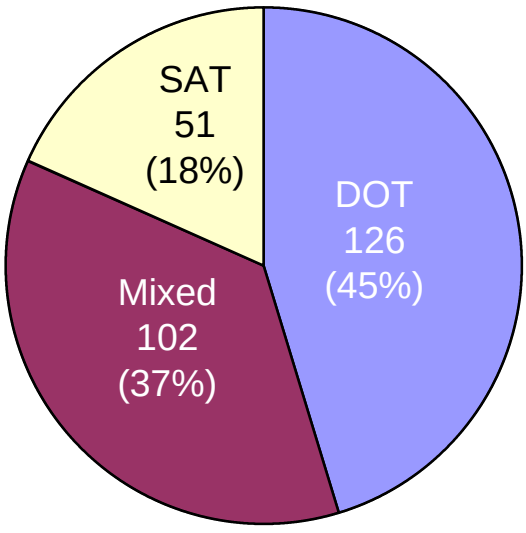

Figure 21: Use of DOT in San Diego County TB Cases, 1999

a history of psychiatric disorders, unstable housing, a history of substance abuse, severe immunosuppressive diseases or conditions, patients taking multiple medications for other conditions, and children.

In 1999, final information on the method of treatment, DOT versus self administered (SAT), was available for 279 of 292 TB cases started on therapy. Approximately 82% of these patients received some or all of their treatment as DOT (Figure 21).

Evaluation of Close Contacts to TB Cases (1995-1999 Cohorts)

TB is transmitted via infectious airborne particles, produced by patients when they cough. Likelihood of transmission depends on six factors: 1) infectiousness of the TB case; 2) proximity of contact to the TB case; 3) duration of contact to the TB case; 4) host susceptibility; 5) the environment in which contact occurs (i.e. the risk increases with poor ventilation); and 6) virulence of the TB strain. When deciding whether an individual who has been in contact with a TB patient needs evaluation for TB infection, all of these factors should be considered. Priority for contact investigation is given to highly infectious cases (e.g. pulmonary disease: AFB smear positive and/or cavitary disease and/or extensive infiltrates), highly susceptible contacts (e.g. children and immunosuppressed contacts), and contacts with prolonged, close exposure to the source case (e.g. household members).

From 1995 to 1999, San Diego County TB Control identified 7, 605 close contacts of TB cases (Table 4). Six thousand six hundred seventy-three (88%) of these received an evaluation for TB infection by San Diego TB Control or by a community provider.

	1995	1996	1997	1998	1999	Total
Contacts Identified	2,225	1,627	1,383	1,145	1,225	7,605
Contacts examined	1,830 (82%)	1,432 (88%)	1,246 (90%)	1,051 (92%)	1,114 (91%)	6,673 (88%)
Contacts per case	8	7	6	5	6	6

Table 4: Contacts TB Cases Evaluated, 1995-1999

Treatment of Latent TB Infection (1995-1999 Cohorts)

The majority of patients who are infected with TB do not become ill with disease immediately after infection. Most individuals achieve a state of equilibrium in which TB organisms remain alive within their body, but do not multiply and cause disease. This state is know as latent infection. Persons with latent infection remain at risk for the development of disease, known as reactivation, for the rest of their lives. The overall lifetime risk for progression from latent infection to active disease is approximately 10%. About half of this risk occurs within the first two years after infection. The risk for progression to active disease is much higher for immunosuppressed persons. For example, AIDS patients who are infected with TB have an estimated risk of developing active TB of 8% per year.

The risk of progression to active disease can be greatly reduced by providing treatment for latent infection. Latent TB is usually treated with a single medication (isoniazid) for nine months or with multiple medications (rifampin and pyrazinamide) for two months. Guidelines for treatment of latent TB infection can be obtained from San Diego County TB Control, the Centers for Disease Control and Prevention, or the American Thoracic Society. San Diego County TB Control Clinic completion rates for treatment of latent infection are shown in Table 5. From 1995 to 1999, 8, 102 patients were started on treatment for latent infection. Of these, 5, 975 (74%) completed therapy.

	1995	1996	1997	1998	1999	Total
Patients started on treatment*	1,861	1,817	1,631	1,295	1,498	8,102
Completion rate all patients	**75% (1,403)**	**78% (1,426)**	**75% (1,218)**	**64% (832)**	**69% (1,096)**	**74% (5,975)**
Contacts <15 yrs.	74% (57)	86% (73)	73% (33)	81% (42)	87% (27)	80% (232)
Contacts ≥15 yrs.	68% (138)	74% (125)	68% (71)	65% (75)	66% (69)	69% (478)
Others	76% (1,208)	79% (1,228)	75% (1,114)	68% (715)	73% (1,000)	(75%) (5,265)

* excludes patients still on therapy and those who moved

Table 5: Completion of Treatment for Latent Infection 1995-1999

Contacting San Diego County TB Control

Mail:
TB Control
P.O. Box 85222
P511D
San Diego, CA 92186-5222

Phone:
General information: 619-692-5565
Medical Provider Reporting: 619-692-8610
Epidemiology: 619-542-4019
Health Education: 619-692-8620

Fax:
619-692-5650

Internet:
http://www.co.san-diego.ca.us/cnty/cntydepts/health/services/tb/index.htm